

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: FORREST, et al. CONFIRMATION NO. 5397
SERIAL NO.: 10/581,622 GROUP ART UNIT: 1794
FILED: June 5, 2006 EXAMINER: Lawrence D. Ferguson
FOR: FREE-STANDING SILICON CARBIDE ARTICLES FORMED BY
 CHEMICAL VAPOR DEPOSITION AND METHODS FOR THEIR
 MANUFACTURE

ATTORNEY DOCKET NO.: 52993/326894

DECLARATION OF DAVID SLUTZ, Ph.D.

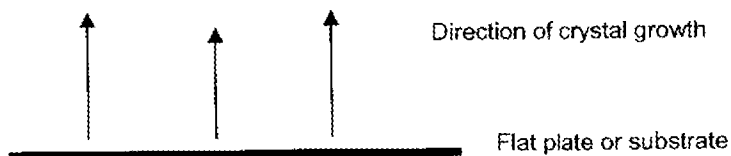
I, Dr. David Slutz, declare as follows:

1. I am over the age of majority and am competent to make this Declaration based on my personal knowledge. I understand that this Declaration will be used in the United States Patent and Trademark Office in connection with the above-identified pending patent application.
2. I am a Senior Scientist for Morgan Advanced Ceramics. I have a Masters of Science Degree in Material Sciences from Iowa State University and a Ph.D. in Ceramic Engineering from Iowa State University. I have worked in the technology area of chemical vapor deposition and silicon carbide articles for 24 years. I have been managing the project directed to developing and manufacturing the technology described in the above-referenced patent application at Morgan for 3 years.

3. I have also reviewed the March 4, 2009 Office Action and all of the references cited in that Office Action.

4. Particularly, I have reviewed the Goela patents (U.S. Patent Nos. 6,464,912 and 6,939,821) and the Examiner's rejections using the Goela patents. The Examiner states that "it is inherent for the [Goela] structure to have grains substantially oriented in the planar direction and oriented in a substantially radial direction around the circumference of the ring." See Office action pages 7 and 12. I disagree with that statement for the following reasons.

5. As background and as described in the above-referenced application at pages 1-6 (incorporated in this declaration by reference), chemical vapor deposition (CVD) may be used to form free-standing silicon carbide articles. Typically, precursor gases or vapors are fed into a deposition chamber and allowed to react at the surface of flat plates, substrates, or other structures placed in the chamber. When the silicon carbide builds up as a deposit on the plate or substrate, the direction of the crystal growth is perpendicular to the plane of the flat plate or substrate, as illustrated below.



6. Further support for the natural grain growth being normal or perpendicular to the surface of the substrate during CVD methods is provided by KIM, Y., et al., "Microstructure

comparison of transparent and Opaque CVD SiC", *J. Am. Ceram. Soc.*, Vol. 78 (6), pp. 1571-1579, 1995 (*see* figure (a) and accompanying discussion at pages 1575-76) and IVANOVA, L.M., et al., "Thermoelectric properties of vapor-grown polycrystalline Cubic SiC", *Inorganic Materials*, Vol. 42 (11), pp. 1205-1209, 2006 (*see* page 1206). I understand that both of these references were cited in this application in a recent Information Disclosure Statement.

7. If ring-like structures are to be formed from a deposit formed on a flat plate, rings are cut from the sheet of material. The material around each ring and between each ring is typically wasted, which results in a large quantity of scrap material, much like unused cookie dough after cookies are stamped out from a sheet of cookie dough. Other problems with rings formed in this matter are described in more detail in the above-referenced patent application.

8. In an attempt to alleviate some of this waste, the Goela '921 patent describes suspending ring-like substrates 20 in a deposition box, injecting precursor gases, and forming silicon carbide deposits on both sides of the substrates. *See* Goela '912 at col. 4; col. 6. Separation of the substrates from the deposits results in the production of two silicon carbide rings, one on each side of the substrate. *See* col. 6, lines 62-65 and Goela FIG. 1, reproduced below.

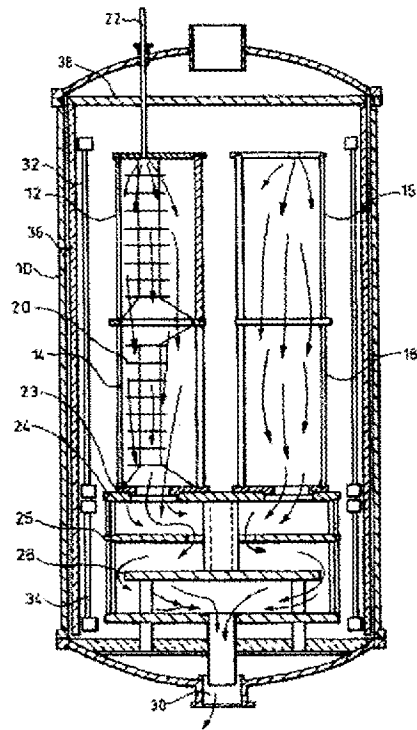


Fig.1.

9. In another embodiment, Goela envisions suspending ring-like mandrels 186 along a suspension support 184 in a deposition box in order to conduct the deposition and produce the desired rings, as shown in FIG. 7, reproduced below.

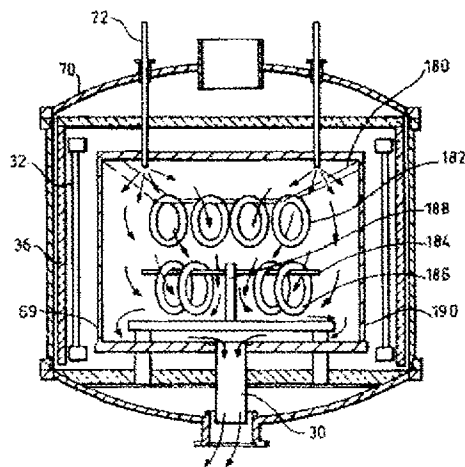
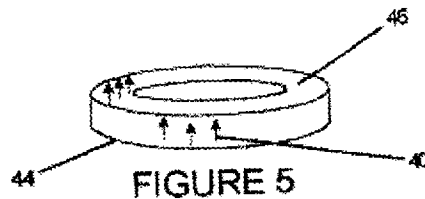
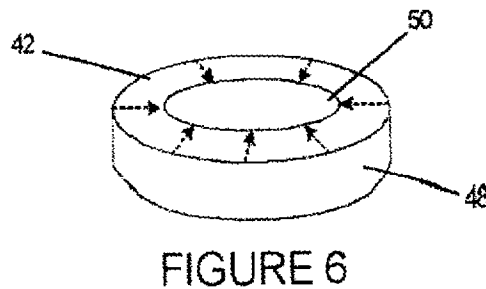


Fig.7.

10. It is not inherent that the structure of the Goela grains will be oriented in the planar direction of the article. In fact, the exact contrary is true. In all of the Goela methods, the grains of the resulting material will be oriented perpendicular to the substrate or ring-like mandrel. The deposition of the material on top of the ring-like substrate results in the prior art structure shown in Figure 5 of the present application, reproduced below.



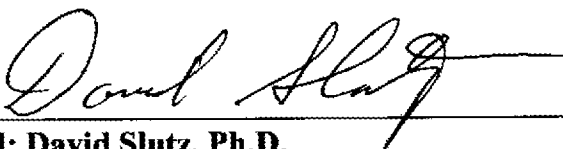
11. By contrast, the claims of the present application all recite a structure that has a dimension in the planar direction that is larger than the dimension in the normal dimension and having grains substantially oriented in the *planar* direction. An example of this is shown in FIG. 6 of the present application, reproduced below.



12. One way that the claimed structures can be made is by depositing a material along a cylindrical tube and then cutting, slicing, or dividing the resulting tubular material to form rings having grain growth that is oriented in the plane of the article.

13. I declare that all statements made herein of my own knowledge are true and that all statements made on information or belief are believed to be true, and further that the foregoing statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of the above-referenced application or any patent issuing thereon.

Dated: 6/29/09


Signed: David Slutz, Ph.D.

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